

SPAWNING BEHAVIOUR OF *SERGIA LUCENS* (HANSEN) (DECAPODA: SERGESTIDAE)

The 'Sakura-ebi' *Sergia lucens* (Hansen) has provided the base of an historic fishery in Suruga Bay, on the south coast of Honshu, since 1894. Today, the annual catch totals 2500 to 3000 metric tons, more than US\$20 million in landed value. Research on the shrimp is well advanced (Omori, 1969; Omori *et al.*, 1973).

Sergia lucens completes its life cycle in Suruga Bay. Spawning occurs at 1 year of age, from June to the middle of November. One female produces about 2000 eggs. The eggs are primarily spawned near the mouth of the rivers at the head part and the western part of the bay. The eggs are planktonic, and are distributed mostly at depths ranging from 20–50 m, where the temperature is higher than 18°C, which is the lower limit of the optimal temperature range (18°–25°C) for spawning and larval development (Omori, 1971; Omori and Jo, 1989). Eggs hatch into nauplii after 24–36 hrs under normal environmental temperature conditions. The larvae attain a length of 20–25 mm and recruit to the fishery at 3–4 months old. The fishery is based on a species with a lifespan of only 1.5 years, and the recruitment is instrumental in determining year-class strength.

In 1985 and 1986, frequent sampling of the 0–50 m water column by vertical tow net was conducted at 2 stations at the head of the bay for July, August and September. In addition, samples were obtained once a month from June to October at 8 stations in the entire bay. The abundance and distribution of eggs and larvae were analysed in relation to possible causes of the temporal and spatial variations.

Daily fluctuation in egg abundance was considerable. The coefficient of variation in July varied from 81–269% (Bishop *et al.*, 1989). In 1985 spawning occurred from the beginning of July, whereas in 1986 it occurred after the middle of July. In August when the seasonal thermocline is particularly marked and the optimum temperature zone narrow, spawning was reduced.

The possibility of a second peak of spawning was suggested in September 1985. In 1986 spawning activity did not recover at the head of the bay, as the principal spawning area seemed to have shifted from the head to the western part. Under favourable conditions, *S. lucens* may produce two broods in one season with a considerable interval between.

Many external and internal factors may be involved in the spawning activity of *S. lucens*. Among them, temperature

seems to be the most important. The start of heavy spawning is roughly associated with the warming of the surface water to 24°C and vertical oscillation of the 18°C-isotherm depth. The temperature around 40 m rapidly increases to 18°C, 3–7 days before the spawning peaks. Temperature at 20–50 m depth affects the abundance and growth of the larvae, whereas food is abundant and would not have great an effect. Correlations between spawning and lunar period were not significant. In general, the potential size of stock for the following year is largely affected by the production and survival of eggs and larvae during the early spawning season. There is a positive relation ($r < 0.01$) between year-class strength and yearly average width of the optimum temperature zone from June through to August at the head of the bay (Nakamura, 1982).

Literature Cited

- Bishop, G.H., Omori, M., and Muranaka, F. 1989. Temporal and spatial variations in the spawning activity of the micronektonic shrimp, *Sergia lucens* (Hansen) in Suruga Bay, Japan. *Journal of the Oceanographic Society of Japan* 45: 243–250.
- Nakamura, V. 1982. Oceanographic feature of Suruga Bay from view point of fisheries oceanography. *Bulletin of the Shizuoka Prefectural Fisheries Experiment Station (Spec. No.)* 17: 1–153. [In Japanese].
- Omori, M. 1969. The biology of a sergestid shrimp *Sergestes lucens* Hansen. *Bulletin of the Ocean Research Institute, University of Tokyo* 4: 1–83.
1971. Preliminary rearing experiments on the larvae of *Sergestes lucens* (Penaeidea, Natantia, Decapoda). *Marine Biology* 9: 228–234.
- Omori, M., and Jo, S.-J. 1989. Plankton sampling system with a new submersible vortex pump and its use to estimate small-scale vertical distribution of eggs and larvae of *Sergia lucens*. *Bulletin of Plankton Society Japan* 36: 19–26.
- Omori, M., Konagaya, T., and Noya, K. 1973. History and present status of the fishery of *Sergestes lucens* (Penaeidea, Decapoda, Crustacea) in Suruga Bay, Japan. *Journal du Conseil, Permanent International pour l'Exploration de la Mer* 35: 61–77.

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